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CONTINUATION OF DENSITY CALIBRATION IN SPACE

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INTRODUCTION

The objective of this program is to design, construct and test a prototype pressure calibration system applicable to in-flight calibration of ion gauges installed on an orbiting satellite. The method of calibration is based on the production of a known pressure in an ion gauge chamber by controlling the flow of a calibration gas into and out of the gauge chamber. During the initial period of this contract two hydrogen diffusers were designed, constructed and tested. The results of these tests were applied to the design and construction of the Mark III prototype in-flight calibration system. The purpose of this continuation of Contract NAS5-3959 is to experimentally evaluate the performance of the Mark III prototype system. This is the first bi-monthly technical report on the progress of the program.

PROGRESS

In order that the testing of the Mark III prototype system be carried out with a low background pressure it is desired that rigorous outgassing of the entire system be carried out at 450°C. To this end a support table was added to the vacuum system to accommodate an existing bakeout oven which will enclose the Mark III system, the high vacuum valve, gauges, and the uppermost liquid nitrogen cold trap. 90° elbow fittings joined to gold o-ring seal flanges were fabricated in order that both magnetron gauges be accommodated within the bakeout oven.

The Mark III prototype system was joined through a Kovar seal to a gold o-ring seal flange. The performance tests will be carried out with the system configuration shown

in Figure 1. In order to determine the characteristics of the magnetron gauge used in the prototype system comparison will also be made to a hot filament type gauge joined to the system in place of the reference magnetron gauge.

With a blind flange installed in place of the Mark III system the vacuum system was activated and a bakeout at 380°C was performed. A bellows in the uppermost LN_2 cold trap developed a leak. Due to the relative inaccessibility of the bellows a decision was made to redesign and rebuild the cold trapping system with NRC funds. Due to the long delivery time of the new cold traps a six weeks extension in time with no additional funds was requested.

FUTURE WORK

In the next report period rebuilding of the cold trapping system will be completed and the Mark III prototype system will be evaluated as follows:

1) The steady state hydrogen permeation rate will be determined as a function of diffuser temperature.

2) The hydrogen flux contribution to gauge pressure will be determined for the diffuser "cold". The effect of heat sink temperature on this flux contribution will be determined.

3) The hydrogen flux through the diffuser and the temperature of the diffuser will be determined as a function of time during the application of a two-level heater power pulse. The first power level will be such that the desired pressure is reached in less than 3.5 minutes. The second power level will be such that the desired pressure is maintained constant within $\pm$ 2% for a period greater than 10 seconds.

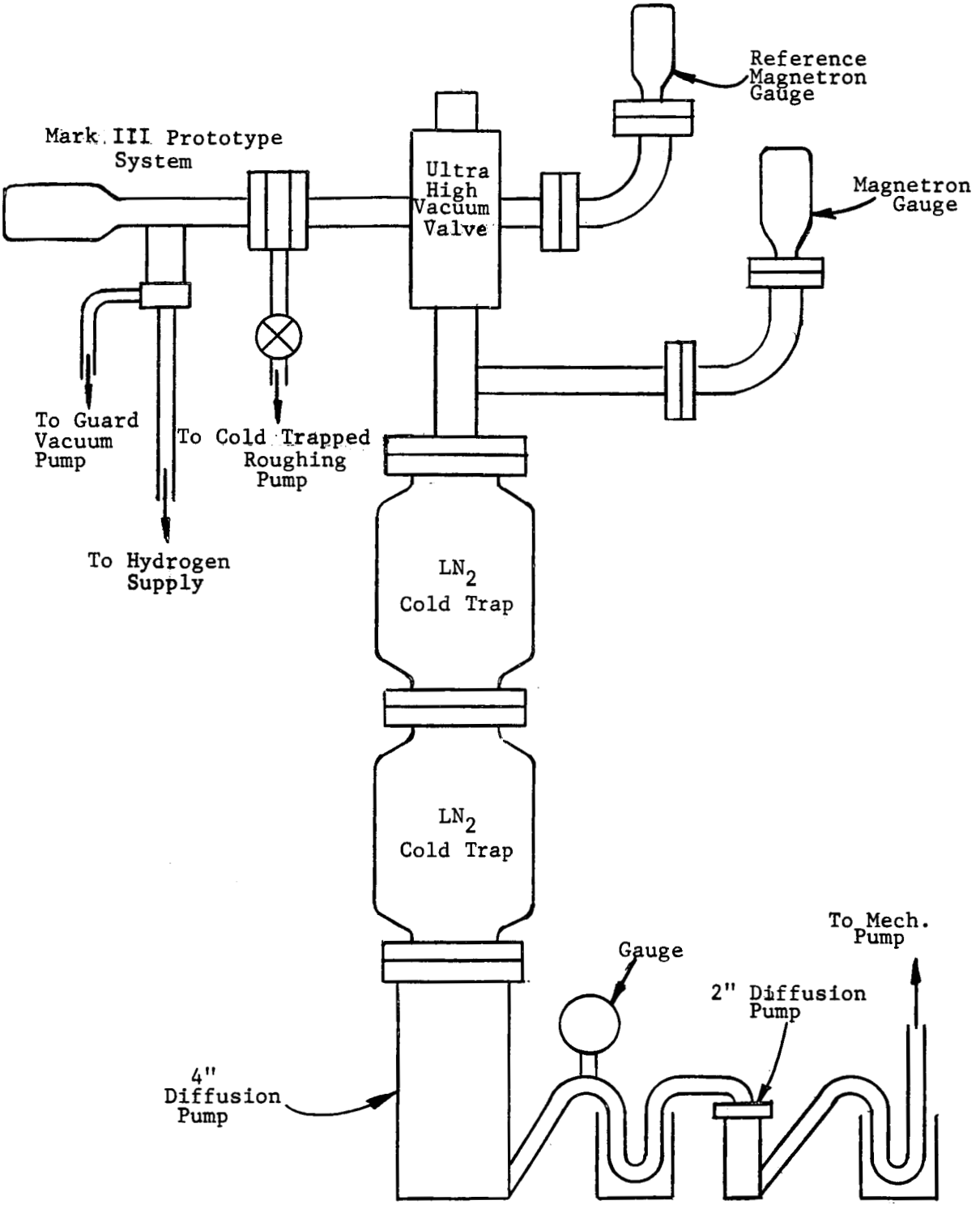

Fig.1: Configuration of System for
Mark III Prototype Performance Testing